

PART III – SECTION J-1



**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

SUBSYSTEM SPECIFICATION

Radio Frequency Line Section

Version 4.0

October 25, 2007

This purchase description establishes the minimum requirements for the government purchase of commercial, off-the-shelf (COTS), Coaxial, RF, Line Sections for the use with the air-to-ground communications equipment systems.

1.1 PURPOSE

The coaxial RF Line Sections specified herein shall be constructed and fabricated for the use at Federal Aviation Administration (FAA) air-to-ground radio communication facilities. The Coaxial RF Line Sections are to be self-permanent mounting and insertion into a 50 ohm nominal impedance transmission line. Using separately procured, commercially available, compatible detecting elements, the Coaxial RF Line Section will be used to monitor the Voltage Standing Wave Ratio (VSWR) of the FAA's Very High Frequency (VHF) and Ultra High Frequency (UHF) communications equipment. Each Coaxial RF Line Section shall adhere to those engineering design characteristics essential to minimize the generation of, and susceptibility to, radio frequency interference (RFI).

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this purchase description and are applicable to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this purchase description, the contents of this purchase description shall prevail.

2.1 Government Documents

The following documents of the issues in effect on the date of the request for proposals (solicitation) form a part of this specification and are applicable to the extent specified here. In case of conflict between the documents referenced here and the contents of this specification, the contents of this specification shall take precedence.

2.1.1 Specifications

FAA:

FAA-G-2100 Electronic Equipment, General Requirements,
October 22, 2001 (Revision G)

MILITARY:

MIL-E-17555(H)2 Electronic and Electrical Equipment Accessories and
Provisioned Items, Packing of, 1992

2.1.2 Standards

FEDERAL:

FED-STD-151(B)2 Federal Test Method Standard Metals: Test Method,
November 24, 1967

FAA:

FAA-STD-013B Quality control Program Requirements, 1994

FAA-STD-024B Preparation of Test and Evaluation Documentation,
1994

DI-BCATS-97-001 NAS System Asset Identification Report, March
2002

MILITARY:

MIL-STD-129L Military Standard Marking for Shipment and Storage,
1990

MIL-STD-454 General Requirements for Electronic Equipment
May 28, 1997

MIL-STD-461 Electromagnetic Emission and Susceptibility
Requirements for the Control of Electromagnetic
Interference, August 20, 1999

MIL-STD-1189B Bar Code Symbolology, June 1997

2.2 Documentation sources

2.2.1.1 The documents are available at
<http://faa.gov/AND/AND300/AND360/Library.htm>.

2.2.1.2 Documentation Sources

2.2.1.3 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the NEXCOM Contracting Officer, FAA, 800 Independence Avenue SW, Washington, DC 20591. Requests should clearly identify the desired material by number and state the intended use of the material. Revision FAA-G-2100G may be downloaded from the FAA at web site <http://www.faa.gov/asd/standards/index.htm>.

2.2.1.4 Military and Federal Documents

Single copies of unclassified military and federal specifications, standards, and publications may be obtained by writing the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120 or by calling (215) 697-3321 Monday through Friday, 8:00 a.m. to 4:30 p.m. (EST).

2.2.1.5 Federal Communications Commission Documents

Copies of 47 CFR, Part 2 and Part 87 may be obtained from the FCC, 445 12th Street, S.W., Washington D.C. or by downloading from the FCC web site at www.fcc.gov/oet/info/rules.

2.2.1.11 ETSI Documents

Copies of European Telecommunications Standards Institute documents may be obtained from the ETSI Secretariat at F-06921 Sophia Antipolis CEDEX – France by requesting a copy via the ETSI web site secretariat@etsi.fr.

2.2.1.12 ISO/IEC Documents

Copies of International Standards Organization documents may be obtained from American National Standards Institute, 11 West 42nd Street, 13th floor, US-New York, N.Y. 10036. Tele: 1 212 642 4900, Telefax: 1 212 398 0023, E-mail: info@ansi.org, Web: <http://www.ansi.org/> or <http://www.iso.ch/>.

3.0 REQUIREMENTS

3.1 General

The Coaxial RF Line Section shall be constructed and fabricated to ensure compliance with all the requirements contained herein and in the contract schedule.

3.1.1 Deliverables

The contractor shall provide all necessary resources to fabricate, test and deliver the Coaxial RF Line Sections in accordance with this purchase description.

3.1.1.1 Interface Requirements

3.1.1.2 External Interfaces

RF Interface: The Coaxial RF Line Sections shall interface with 50-ohm coaxial transmission systems.

DC Interface: The Coaxial Line Section shall have a DC interface to mate with Navy type DS-491859 cable connector.

3.1.1.3 Internal Interfaces

The Coaxial RF Line Sections construction shall enable the removal and insertion of interchangeable detecting elements in any configuration, without causing or inducing damage or transients to any equipment external to the Coaxial RF Line Section.

3.1.1.4 Environmental Conditions

The Coaxial RF Line Section shall be constructed of materials to withstand any combination of environmental and service conditions specified in FAA-G-2100, Electronic Equipment, General Requirements, section 3.2.1, Environmental Conditions, with out damage of degradation of performance below the requirements of this purchase description.

3.1.1.5 Ambient Conditions

The Coaxial RF Line Section shall operate over the range of ambient conditions for unattended facilities. The temperature will be between -10C to 55C. The relative humidity will be between 5% to 90%. Where the relative humidity for temperature above 40C, it will be based on a dew point of 40C. The altitude (in feet) shall be from sea level to 15,000 feet.

3.1.1.6 Operating Temperatures

The Coaxial RF Line Section shall be fully operable at all temperatures between -18 and +55 degrees Celsius at a relative humidity of 5 to 90 percent.

3.1.1.7 Non-Operating Conditions

Non-operating conditions for the equipment are those conditions affecting equipment in storage, in shipment, in the process of being installed on site and installed on site but non-operating. The equipment shall meet the requirements of FAA-G-2100, section 3.2.1.2, Non-Operating Conditions.

3.1.1.8 Impedance

The Coaxial RF Line Section shall exhibit nominal impedance of 50 ohms.

3.1.1.9 Insertion Loss, VSWR

The insertion loss for the Coaxial RF Line Section shall not exceed 0.10 dB at maximum operating frequency of 1 GHz. The insertion VSWR of the Coaxial Line Section shall not exceed 1.07 at a maximum operating frequency of 1 GHz.

3.1.2 Configuration

The following items shall be included with each assembly delivered in accordance with the requirements of the contract schedule:

3.1.2.1 Configuration 1

<u>Item</u>	<u>Qty</u>
a. Line Section Body	1 each
b. Mounting Bracket	1 each
c. Protective Cap with Captivation Chain	1 each
d. Attached Type N Female Connectors	2 each
e. Attached DC Output Connector	1 each

3.1.2.2 Configuration 2

<u>Item</u>	<u>Qty</u>
a. Line Section Body	1 each
b. Protective Cap with Captivating Chain	1 each
c. Attached Type N Female Connectors	2 each
d. Attached DC Output Connector	1 each

3.2 Characteristics

3.2.1 Physical Requirements

3.2.1.1 Physical Characteristics

The equipment shall be constructed, fabricated, and delivered in accordance with the requirements contained herein.

3.2.1.1.1 Line Section Body

The line section body shall be fabricated from a high quality material, in accordance with paragraph 3.2.6.1. The line section body will contain a 1" diameter element insertion port, one "N" type female input RF connector, one "N" type female output RF connector, and one DC output test connector. The line section body will mount from the rear of an equipment panel (Configuration 2 herein) or mount on the surface of an equipment panel using the mounting bracket (Configuration 1 herein). The line section body element insertion shoulder must fit a rectangular panel opening not to exceed 1-9/16" wide x 1-5/16" high. The shoulder length shall be designed such that it does not impede use of the locking clip when assembled upon a 0.125" thick rack panel. The shoulder length may extend up to 0.125" beyond the plane created by the front face of the rack panel. The line section body will be drilled and tapped to accommodate two 10-32 mounting screws. The mounting holes will be on 2-1/8" centers along the length of the face of the line section body and will center the element insertion port within the above rectangular opening. Mounting holes will be equally spaced on either side of the element insertion port. Inside the element insertion hole a spring type mechanism device shall be made to assure the element will make electrical contact with the bottom of the element. A small retaining clip shall be mounted near the edge of the element of the insertion hole with a set screw to secure or release the protective cap.

3.2.1.1.2 Mounting Bracket

A metal wrap-around "U" shaped mounting bracket shall be supplied with coaxial RF Line Sections ordered under the requirements of configuration 1 as specified in paragraph 3.1.2.1 herein. The bracket will encompass the line section body and be formed into two protruding mounting flanges. Each flange will not exceed 1/2" in width. The flanges will be drilled with four 13/16" diameter holes (two per flange) to permit permanent mounting of the line section body to a flat surface such as blank equipment panel. The holes will be on 3" centers as measured along the length of each flange and 1-7/8" centers as measured across the base of the mounting bracket between the two mounting flanges. Two stainless steel mounting screws with lock washers, or equivalent, will be used to affix the mounting bracket to the line section body. The mounting bracket will use the same mounting holes as defined in paragraph 3.2.1.1.1 herein. The mounting bracket will also be configured to permit permanent attachment of one end of the protective cap and captivating beaded chain.

3.2.1.1.3 Coaxial connectors

Each unit shall be supplied with the “N” female coaxial connectors attached to the line section body. Each connector will be interchangeable with other series and genders of connectors currently available from commercial sources and will be attached to the line section body with four stainless steel screws and lock washers, or equivalent. Connectors will not require any soldering to remove or replace.

3.2.1.1.4 DC Connector

The Coaxial RF Line Section shall contain one DC output connector. This connector will mate with a Navy DS-491859 type cable connector and will be affixed to the line section body with two stainless steel screws and lock washers, or equivalent. The DC connector will mate with existing commercially available metering units.

3.2.1.1.5 Protective Cap

A metal protective cap (dust plug), with captivating beaded chain, shall be supplied with the line section body to be used for mating with the element insertion port when there is no element inserted. The captivating beaded chain will be approximately 3” in length. One end of the chain will be permanently affixed to the protective cap and the other end will be affixed to the line section body for assemblies meeting the requirements of paragraph 3.1.2.2 herein or the mounting bracket for those assemblies meeting the requirements of paragraph 3.1.2.1 herein.

A locking clip shall be supplied upon the line section body for retention of a dust plug or an insertion element when these items are inserted into the line section body. Clockwise movement of the locking clip will retain the dust plug or element in the insertion port. A counter-clockwise movement will release the dust plug or element in the insertion port. The locking clip shall be located on the element’s insertion shoulder and not impede access to the user when rack panel mounted. Note: The preferred location for mounting the locking clip onto the insertion shoulder is on the side opposite that of the DC output connector.

3.2.1.2 Mechanical Construction

The equipment’s construction shall permit ready access to all connectors and plugs. The structural strength and rigidity of the equipment will be such that normal handling in loading, shipping, unloading and setting into position in another FAA standard configuration will not result in any permanent attachment or deformation that would impair or interfere with the operation.

3.2.2 Equipment Layout

The internal Coaxial RF Line Section layout shall be capable of accommodating all commercially available detecting elements currently being utilized by the FAA (Bird Watt Meter).

3.2.3 Equipment Size

The Coaxial RF Line Section as specified here in for Configuration 1 shall not exceed the following dimensions:

5-1/2" Length x 2-1/2" Width x 2-1/2" Height

The Coaxial RF Line Section as specified herein for Configuration 2 shall not exceed the following dimensions:

5-1/2" Length x 1-5/16" Width (Without connector) x 2-1/2" Height

3.2.4 Equipment Weight

The Coaxial RF Line Section shall not exceed 5 pounds in weight for both configuration 1 and configuration 2 as specified herein.

3.2.5 Installation and Removal

The coaxial RF Line Section shall be so designed that it can be easily installed, removed, and reinstalled with a minimum of common tools without extensive disassembly.

3.2.6 Materials, Processes, and Parts

3.2.6.1 Materials

All materials used in the Coaxial RF Line Section shall be new and will conform to the highest-grade specification. This means that the materials will be equal to or better than those meeting applicable industrial standards and suitable for the purpose intended. All material will be as specified in FAA-G-2100, section 3.3.1.1, Materials.

3.2.6.1.1 Ferrous Materials

Ferrous materials shall be corrosion resisting type or shall be suitably protected to be capable of withstanding a salt spray test for a minimum of 48 hours as specified in FED-STD-151, Metals: Test Methods.

3.2.6.1.2 Adhesives

Adhesives shall be resistant to swelling or other deterioration caused by contact with air; moisture, fungus, gases, ozone or solvents that will encountered in use. Adhesives, which are not compatible structurally, shall not be used.

3.2.6.2 Parts

All parts used in the Coaxial RF Line Section shall be operated within their electrical ratings and the environmental requirements of this purchase description.

3.2.6.3 Processes

Processes used in the construction of the Coaxial RF Line Section shall be in accordance with FAA-G2100, Section 3.3.1.2, Equipment Manufacturing Processes.

3.2.7 Electromagnetic Emission and Susceptibility

Testing requirements of MIL-STD-461, Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic interference, Part 4, Requirements for Equipment and Subsystems Installed in Ground Facilities, as implemented by a Contractor tailored, and government approved EMC test plan, shall be used to determine compliance with the applicable emission and susceptibility requirements. Testing shall be aimed at preventing and detecting any RF leakage or ingress that may result from the insertion of the Coaxial RF Line Section in the transmission system. For the purpose of this test the Coaxial RF Line Section is considered to be part of the transmission system. Emission testing will be done using a minimum of three frequencies in each band, i.e. VHF band (117.979 to 137.975 MHz) and UHF band (225.000 to 399.975 MHz). Selected frequencies will include, but not limited to, one frequency in the mid-point of the band, one frequency approximately 10 percent below the lowest frequency in the band, one frequency approximately 10 percent above the highest frequency in the band. Emission testing will be accomplished with a 20 watt Continuous Wave (CW) RF source providing input to the Coaxial RF Line Section installed in a 50-ohm transmission system. The transmission system will be terminated with a 50-ohm absorptive type load. The test will be repeated using a 75-watt CW RF source. Susceptibility test will be made with the Coaxial RF Line Section installed in a 50-ohm transmission system. The transmission system will be terminated with the test monitoring equipment. The Coaxial RF Line Section will be subjected to RF fields up to 5 volts per meter over the frequency range of 30 MHz to 2 GHz. All emission and susceptibility test will be made with the protective cap installed. As a minimum the following requirements from MIL-STD-461, Part 4, will be tailored for the Coaxial RF Line Section testing:

RE02, Radiated Emissions, Electric Field
RE03, Radiated Susceptibility, Electric Field

3.2.8 Safety

The inherent design of the Coaxial RF Line Section shall provide for maximum safety to personnel during operation and maintenance. Equipment malfunction shall in no way contribute to the destruction of the equipment or any part of its

environment. Safety shall conform to the requirements in FAA-G-2100 and MIL-STD-454, Requirement 1, Safety Design Criteria-Personnel Hazards.

3.3 Circuit Protection

This paragraph is not applicable to this purchase description.

3.4 Documentation

3.4.1 Test Documentation

All aspects of the Coaxial RF Line Section testing shall be documented. Test documentation will include test plans, test procedures, and test reports. All test documentation shall be delivered to the Government.

3.4.2 Drawings

All drawings associated with the design, test, and application of the Coaxial RF Line Section shall be made available for review upon request by the Government during the life of the contract.

3.5 Interchangeability

Functional interchangeability shall be maintained between the equipment purchased under the requirements of this document and existing FAA Coaxial RF Line Sections. In order to insure uniformity of power readings from unit to unit, the Coaxial Line Section is to maintain a dimension of .3905 +/- .0001 inches as measured from the line section center conductor to the element socket seat. Provisions shall be made for design tolerances. Standard items will be used when available as specified in FAA-G-2100, Section 3.3.4, Interchangeability.

3.6 Workmanship

Workmanship shall be in accordance with the requirements of this purchase description, FAA-G-2100, Section 3.3, Equipment Design and Construction, and MIL-STD-454, Requirement 9, Workmanship. Professional standards for packaging, craftsmanship, and art-work will be followed in all hardware fabrication efforts. Equipment will be fabricated and assembled to produce quality equipment. Workmanship related to the application of standard processes used in the fabrication of Coaxial RF Line Section will conform to the requirements of the process specification called out in the manufacturer's specific assembly drawings. Workmanship shall be applicable to marking parts and assemblies, finishes, machine operation, screw assemblies, and freedom of parts from burrs, sharp edges, or any other damage or defect that could make the part or equipment unsatisfactory for the purpose intended. Parts or hardware will be assembled and secured or mounted in the specified manner to

satisfactorily accomplish the purpose intended. Parts or hardware will be assembled and secured or mounted in the specified manner to satisfactorily accomplish the purpose for which intended. After fabrication, parts and assembled equipment will be cleaned of smudges, loose, spattered, or excess metal chips and mold release agents or any other foreign material, which might detract from the intended operation, function, or appearance of the equipment. Cleaning processes will have no deleterious effect on the equipment or parts. Screws, nuts and bolts will show no evidence of cross threading, mutilation, or detrimental or hazardous burrs. All screw type fasteners will be tight.

3.7 Reliability

The Coaxial RF Line Sections shall exhibit a useful life cycle of at least ten years.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Quality Control Provisions

The Contractor shall be responsible for conducting all inspection and testing as specified herein to assure product conformance with requirements of the contract and this purchase description. All test and inspections made by the contractor shall be subject to government inspection. The contractor shall develop, implement and maintain a quality control program in accordance with FAA-STD-013, Quality Control Systems Requirements, and FAA-G-2100, Section 4, Quality Assurance Provisions.

4.2 Test

A series of factory tests shall be performed on a representative sample of production Coaxial RF Line Sections. Unless otherwise specified, the contractor will use their own facilities or those of a commercial lab acceptable to the government at the contractor's expense. The factory test will demonstrate that the requirements of the purchase description are met. The contractor shall provide all utilities and equipment necessary to perform these tests. The government contracting officer will be notified of the readiness for the government witness. Such notification shall be in time to reach the contracting officer not less than five workdays before testing is to start and government witness is required.

4.3 Contractor Detailed List of Tests

The contractor shall prepare a list of tests to be conducted as specified in FAA-STD-024, Preparation of Test and Evaluation Documentation. This list will identify all detailed tests to be performed and will be made available for review upon request by the government during the life cycle of the contract. These test procedures shall reference the specific purchase description paragraph number being demonstrated. Test will be completed according to the level specified in Appendix A, Verification Requirements Tractability Matrix (VRTM) using the appropriate verification methods as specified. The VRTM traces the individual requirements of Section 3 of this document to the method of verification (i.e., testing, inspection, analysis, and demonstration).

4.4 Inspection Facilities

Inspection facilities to permit performance of the required inspection shall be established and maintained by the contractor. The contractor may use their own or any other facilities suitable for the performance of the inspection requirements specified herein and approved by the government.

4.4.1 Inspection conditions

Unless otherwise specified, all testing shall be performed under the following conditions.

Temperature - Room Ambient, +19C (+67F) to +25 (+77F)
Pressure - Normal Atmospheric (29.92 inches of Mercury)
Humidity - 45 to 50 percent relative humidity

4.4.2 Test Equipment

Test and measuring equipment of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with FAA-G-2100, Section 4.2.4, Test Equipment.

4.4.3 Verification Methods

The four verification methods, (TEST, DEMONSTRATION, ANALYSIS and INSPECTION) listed in decreasing order of complexity, are described as follows;

- a. TEST (T); Test is a method of verification wherein performance is measured during or after the controlled application of functional and environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, items and services.
- b. DEMONSTRATION (D); Demonstration is a method of verification where qualitative determination of properties is made for an end item, including the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.
- c. ANALYSIS (A); Analysis is a method of verification which consists of comparing hardware design with known scientific and technical principles, procedures and practices to estimate the capability of the proposed design to meet the mission and system requirements.
- d. INSPECTION (I); Inspection is a method of verification to determine compliance without the use of special laboratory appliances, procedures or services and consist of non-destructive static-state examination of the hardware, software and/or the technical data and documentation.

4.4.4 Retest

Failure of the equipment to meet specified requirements shall compel the contractor to determine the reason for noncompliance. The contractor shall be responsible for all corrective action necessary to ensure full compliance with the purchase description. The contractor shall complete all repair or rework the extent required before retest. No retest shall be commenced until the contractor has submitted in writing all information concerning the noncompliance and corrective action taken. Prior to submitting the item for government witnessed testing, the contractor shall conduct sufficient testing of the repair or rework to verify that correct measures were effective.. If a review of the reasons for failure to comply with the purchase description requirements indicates that the cause may exist as latent defects in items previously accepted, the contractor shall be responsible for correcting the defects in all units in a timely manner, even those previously accepted by the government. In addition, any adjustments made to equipment during a test shall require that the affected verification process be repeated from the beginning of the test.

4.5 Inspection of Fabrication and Production Status

All information regarding the construction, fabrication, testing, delivery and installation status of the equipment shall be, available for review by the FAA, upon request, at any stage during the contract.

5 PACKAGING, AND SHIPPING

5.1 Packaging

The line section will be packaged in accordance with MIL-STD-129L.

5.2 MARKING

5.2.1 All equipment shall be marked IAW MIL-STD-129 and MIL-STD-1189. In addition to MIL-STD-129 and MIL-STD- 1189, each shipping container shall be marked with the following information:

- a. [Bar code for NSN]
- b. "Line Section"
- c. National Stock Number
- d. Contract Number

In addition to the above markings, the following shipping address shall appear on each shipping container:

Federal Aviation Administration
Mike Monroney Aeronautical Center
6500 S. MacArthur Blvd.
Oklahoma City, OK 73125
Attention: Receiving Dock

NAMEPLATE Each line section shall have a nameplate permanently attached to the front of the unit. The nameplate should contain the following information:

NSN: TBD

CONTRACT NO. XXXXXX-XX-X-XXXXX (Where XX is the contract number.)

5.3 STORAGE AND TRANSPORTATION (FAA LOGISTICS CENTER)

- a. All equipment shall be transported by the most economical means considering dependability, safety, urgency of need and the use of the least costly mode meeting these considerations. All material shall be shipped F.O.B. Destination.
- b. The Contracting Officer and the FAA Logistics Center shall be providing the following pertinent information (in writing) 30 days prior to Delivery date.
 - a. contract number
 - b. National Stock Number & Material-Management-Code;
 - c. Number of Pieces;
 - d. Weight and Dimensions of each piece in each shipment; and
 - e. Any special storage requirement.

Notice shall be made to:

FAA,
Contracting Officer
AJA-47
800 Independence Ave.
Washington, DC 20591

Or matt.asai@faa.gov